CHARACTERISTICS OF DEIONISED WATER

(A) DEFINITIONS OF PURIFIED WATER

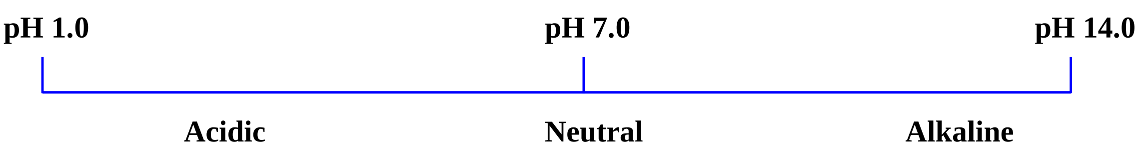
Table 5 provides a definition of purified water quality in terms of the ionic impurities only; it lists three grades of deionised water - ultra-pure, pure and purified water - each with a specified range of resistivity/conductivity. Table 6 is a conversion chart for conductivity and resistivity; one is the reciprocal of the other.

(B) RESISTIVITY AND TEMPERATURE

The resistivity and conductivity of water are temperature-dependent. If the temperature rises by 1°C, the conductivity of mains water will increase by approximately 2%, whereas that of ultra-pure water will increase by up to 6%. It is standard practise to correct conductivity and resistivity to 25°C, a process which is carried out automatically by modern conductivity meters. Figure 22 plots the resistivity of ultra-pure water against temperature.

(C) pH MEASUREMENTS IN DEIONISED WATER

The pH of water is a measure of its acidity or alkalinity, and is defined as: pH = $-\log_{10} [H^+]$, where $[H^+]$ is the nolar concentration of hydrogen ions. pH values are defined on a scale from 1 to 14, with ultra-pure water having a neutral pH of 7.0.



The pH of ultra-pure water is difficult to measure. Not only does high-purity water rapidly pick up contaminants - such as carbon dioxide (CO_2) - that affect its pH, but it also has a low conductance that can affect the accuracy of pH meters. For instance, absorption of just a few ppm of CO_2 can cause the pH of ultra-pure water to drop to 4.5, although the water is still of essentially high quality.

The most accurate estimation of the pH of ultra-pure water is obtained by measuring its resistivity; for a given resistivity, the pH must lie between certain limits. For example, if the resistivity is 10.0 MΩ.cm, the pH must lie between 6.6 and 7.6. The relationship between the resistivity and pH of high-purity water is shown in Figure 23.

Table 5: Definition of purified water quality (in terms of ionic impurities only)

MΩ .cm @ 25°C	Ω .cm @ 25°C	µS.cm @ 25°C	Total dissolved solids in parts per million	
Electrical Resistivity		Electrical Conductivity	TDS in ppm (approx.)	
18	18,000,000	0.0555	-	**ULTRA-PURE WATER**
10	10,000,000	0.1	-	
5	5,000,000	0.2	-	**PURE WATER**
2	2,000,000	0.5	-	
1	1,000,000	1.0	0.7	
0.5	500,000	2	1.4	**PURIFIED WATER**
0.2	200,000	5	3.5	
0.1	100,000	10	0.7	
0.05	50,000	20	14	
0.02	20,000	50	35	

Quality:	**ULTRA-PURE WATER**	**PURE WATER**	**PURIFIED WATER**
Typical Resistivity: or	10 - 18 MΩ.cm	1 - 10 MΩ.cm	1 - 0.02 MΩ.cm
Conductivity:	0.1 - 0.0555 µS/cm	1.0 - 0.1 µS/cm	1 - 50 µS/cm
Produced by:	Polishing mixed-bed system e.g. nuclear grade resins.	Strongly basic mixed-bed system.	Weakly basic mixed - bed system.

Table 6: **Conductivity versus Resistivity Conversion Chart**

Conductivity (µS/cm)	**Resistivity (ohm.cm)**
0.01	100M
0.02	50M
0.05	20M
0.1	10M
0.2	5M
0.5	2M
1.0	1M
2.0	500K
5.0	200K
10	100K
20	50K
50	20K
100	10K
200	5K
500	2K
1000	1K

Figure 22: Relationship between the resistivity of ultra-pure water and temperature

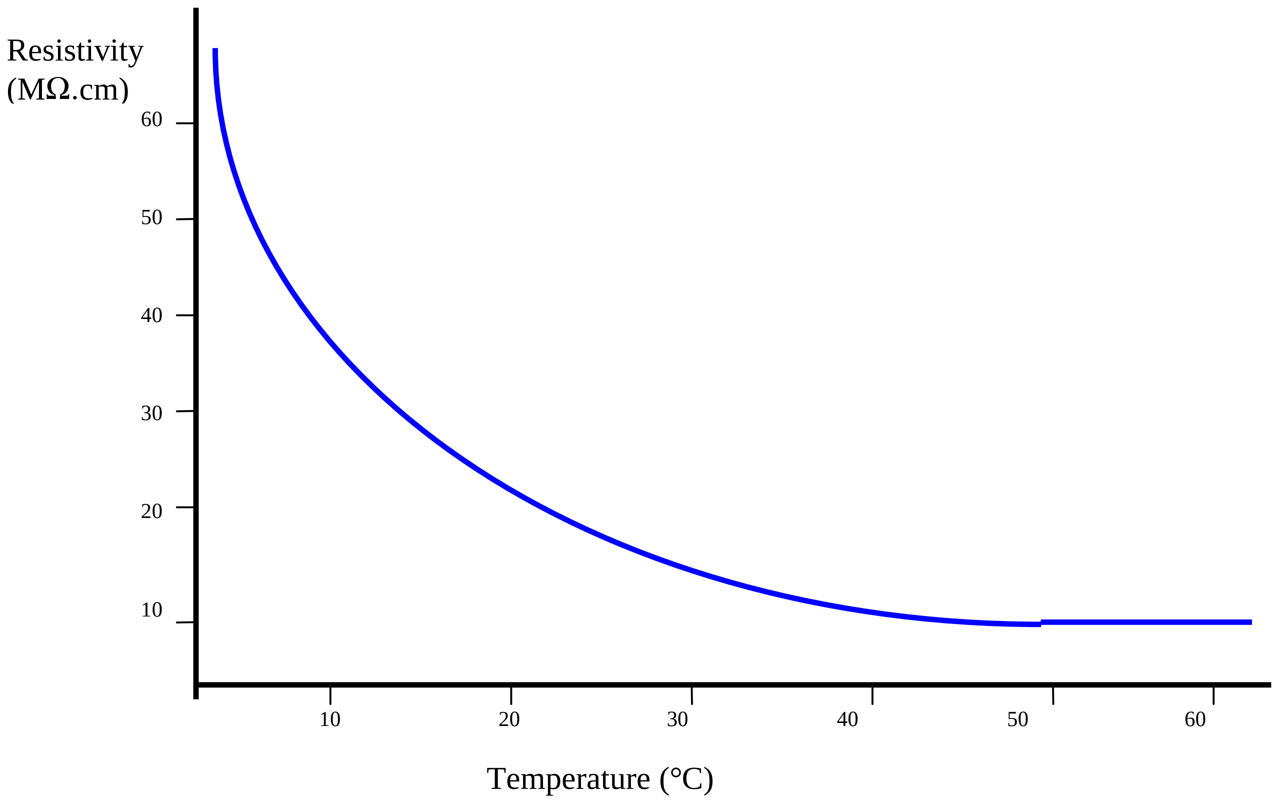


Figure 23: Electrical resistivity versus pH of deionised water